

2021 Red and White Clover Grazing Tolerance Report

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Introduction

Red clover (*Trifolium pratense* L.) is a high-quality, short-lived perennial legume that is used in mixed or pure stands for pasture, hay, silage, soil improvement, and wildlife habitat. This species is adapted to a wide range of climatic and soil conditions. Stands of improved varieties are generally productive for two and a half to three years, with the highest yields occurring in the year following establishment. Red clover is used primarily as a renovation legume for grass pastures. It is a dominant forage legume in Kentucky because it is relatively easy to establish and has high forage quality, high yield, and animal acceptance.

White clover (*Trifolium repens* L.) is a low-growing, perennial pasture legume with white flowers. It differs from red clover in that the stems (stolons) grow along the surface of the soil and can form adventitious roots that may lead to the development of new plants. Three types of white clover grow in Kentucky: Dutch, intermediate, and ladino. Dutch white clover, sometimes called common, naturally occurs in many Kentucky pastures and even lawns. It is generally long lived and reseeds readily, but its small leaves and low growth habit result in low forage yield. The intermediate type is a cross between ladino and Dutch white clover and has been developed to give higher yields than the Dutch type and to persist better than the ladino type under pasture or frequent grazing conditions. Ladino white clover has larger leaves and taller growth than the intermediate and Dutch types and is the highest yielding of the three white clover types.

This report summarizes research on the grazing tolerance of clover varieties when subjected to continuous grazing pressure. Go to the UK Forage Extension website (<https://forages.ca.uky.edu>) to obtain electronic versions of all forage variety

testing reports from Kentucky and surrounding states and a large number of other forage publications.

Important Selection Considerations

Local adaptation and persistence. Select a variety that is adapted to Kentucky as indicated by superior performance across years and locations in replicated trials such as those reported in this publication. Grazing persistence data should be used in combination with yield data to select the best variety for pasture use. White clover generally persists longer than red clover, particularly in wet seasons, and has the ability to reseed even under grazing. Refer to the 2021 Red and White Clover Report (PR-800), or previous years if needed, for yield data on specific varieties of interest.

Seed quality. Buy premium-quality seed that is high in germination and purity and free from weed seed. Buy certified seed or proprietary seed of an improved variety. An improved variety is one that has performed well in independent trials such as those reported in this publication. Other information on the label will include the test date (which must be within the previous nine months), the level of germination, and the percentage of other crop and weed seed. Order seed well in advance of planting time to ensure that it will be available when needed.

Description of the Tests

Tests in this report were established in Lexington for red clover (spring of 2020 and fall of 2020) and white clover (fall of 2017, 2018, and 2020 and spring of 2020). Soils at the test site are well-drained silt loams and are well suited to clover production. Plots were 5 feet by 15 feet in a randomized complete block design with each variety replicated six times.

Table 1. Temperature and rainfall at Lexington, Kentucky in 2018, 2019, 2020, and 2021.

	2018				2019				2020				2021 ²			
	Temp		Rainfall		Temp		Rainfall		Temp		Rainfall		Temp		Rainfall	
	°F	DEP ¹	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP	°F	DEP	IN	DEP
JAN	31	0	2.01	-0.85	33	+2	4.11	+1.25	40	+9	3.72	+0.86	34	+3	4.51	+1.65
FEB	45	+10	9.77	+6.56	42	+7	7.64	+4.43	38	+3	5.14	+1.93	31	-4	4.6	+1.39
MAR	42	-2.	5.16	+0.76	43	-1	3.49	-0.91	51	+7	3.79	-0.61	50	+6	5.12	+0.72
APR	50	-5	5.52	+1.64	54	+4	4.76	+0.88	52	-3	4.92	+1.04	54	-1	2.72	-1.16
MAY	73	+9	8.39	+3.92	69	+5	4.49	+0.02	62	-2	5.69	+1.22	62	-2	4.34	-0.13
JUN	76	+4	6.42	+2.76	73	+1	6.13	+2.47	72	0	2.56	-1.10	73	+1	6.26	+2.60
JUL	77	+1	6.15	+1.15	79	+3	3.30	-1.70	79	+3	3.23	-1.77	75	-1	5.9	+0.90
AUG	77	+2	6.45	+2.52	77	+2	2.42	-1.51	75	0	3.41	-0.52	76	+1	6.16	+2.23
SEP	74	+6	12.88	+9.68	77	+9	0.18	-3.02	68	0	4.43	+0.83	69	+1	3.03	-0.17
OCT	59	+2	6.54	+3.97	61	+4	7.55	+5.58	57	0	4.98	+2.41	62	+5	3.68	-1.11
NOV	42	-3	5.64	+2.25	41	-4	5.39	+2.00	49	+4	2.18	-1.21				
DEC	40	+4	7.35	+3.37	43	+7	5.74	+1.76	36	0	2.27	-1.71				
Total			82.28	+37.73			55.20	+10.65			45.92	+1.37			46.32	+9.14

¹ DEP is departure from the long-term average.

² 2021 data is for ten months through October.

Red clover was seeded at the rate of 12 pounds per acre and white clover at 3 pounds per acre into a prepared seedbed using a disk drill. All seed lots were inoculated prior to planting. Plots were grazed continuously beginning the spring after fall seeding. In general, plots were grazed from mid-May to mid-September to a height of 1 to 3 inches. For spring seeded trials, grazing was started in early July. Supplemental hay was fed during periods of slowest growth.

Visual ratings of percent stand were made in the fall several weeks after the cattle were removed to check stand survival. Ratings were made in the spring prior to resuming grazing to assess winter survival and spring growth. Since trials were seeded in rows, persistence ratings were based on density within a row and not on total ground cover. Fertilizers (lime, P, K, and boron) were applied according to University of Kentucky recommendations.

Results and Discussion

Weather data for Lexington is presented in Table 1. Data on percent stand are presented in tables 2 through 7. Statistical analyses were performed on these data to determine if the apparent differences are truly due to variety or just due to chance. To determine if two varieties are truly different, compare the difference between the two varieties to the least significant difference (LSD) at the bottom of the column. If the difference is equal to or greater than the LSD, the varieties are truly different when grown under the conditions at a given location. The coefficient of variation (CV), which is a measure of the variability of the data, is included for each column of means. Low variability is desirable, and increased variability within a study results in higher CVs and larger LSDs.

Tables 8 and 9 show information about distributors for all red and white clover varieties included in these tests.

How to Interpret the Summary Table

Table 10 is a summary of stand persistence data from 2002 to 2021 of commercial white clover varieties that have been entered in the Kentucky trials. Due to minimal stands remaining after two years of grazing, a summary table for red clover is not included in this report. The data are listed as a percentage of the mean of the commercial varieties entered in each specific trial. In other words, the mean value for each trial is set at 100 percent—varieties with percentages over 100 persisted better than average, and varieties with percentages less than 100 persisted less than average. Direct, statistical comparisons of varieties cannot be made using the Table 10 summary, but these comparisons can help to identify varieties for further consideration. Varieties that have performed better than average over many years have very stable performance; others may have performed very well in wet years or on particular soil types. These details may influence variety choice, and more information can be found in the yearly reports. See the footnote in Table 10 to determine the yearly report that should be referenced.

Summary

Research has shown that abusive grazing tests are a good way to sort out differences in grazing tolerance between varieties in a relatively short period of time. It should be noted that although these varieties were abused during the growing season, they were allowed to rest and regrow after September 15 to prepare for winter. This information should be used along with yield and pest resistance information in selecting the best clover variety for each situation.

For best results, clover should not be continuously grazed as was done in this trial. Even though, several varieties tolerated the level of grazing pressure used in these trials, overgrazing greatly reduces yield and therefore profitability of these clovers.

Table 2. Stand persistence of red clover varieties sown April 3, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.¹

Variety	Percent Stand			
	2020		2021	
	Jun 5	Sep 30	Mar 29	Oct 7
Commercial Varieties-Available for Farm Use				
Freedom!	85	81	78	21*
SS0303RCG	85	84	79	18*
GA9908	80	80	79	18*
Gallant	73	70	70	13
Kenland (certified)	83	71	79	13
Barduro	86	82	73	11
Experimental Varieties				
BARTP9	90	90	90	22*
BARTP11	83	84	80	13
Mean	82	80	79	16
CV,%	14	16	18	49
LSD,0.05	14	15	16	9

¹ This study was originally seeded September 5, 2019, but entire stand was killed by sclerotinia; it was reseeded April 3, 2020.
*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 3. Seedling vigor and stand persistence of red clover varieties sown September 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 2	Percent Stand		
		2020	2021	
		Oct 2	Jul 6	Oct 7
Commercial Varieties-Available for Farm Use				
Freedom!	4.6	100	39	34*
SS0303RCG	4.4	100	28	33*
Kenland (certified)	4.3	100	33	32*
GA9908	4.1	100	10	13
Barduro	4.9	100	10	7
Experimental Varieties				
20-LA-RC-1	4.6	100	32	32*
20-LA-RC-2	4.6	100	26	28*
BARTP11	4.5	100	23	22*
20-AB-RC-3	3.8	100	18	19
BARTP9	4.5	100	16	17
CW30091	3.3	94	9	7
Mean	4.3	99	22	22
CV,%	8.6	1	50	49
LSD,0.05	0.4	1	13	13

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Good management for maximum life from grazing clover would include:

- Allowing clover to become completely established before grazing
- Using rotational grazing where animals harvest available forage in seven days or less followed by resting for 28 days before regrazing; less time is required for white clover
- Adding needed fertilizer and lime
- Removing grazing livestock from clover fields from mid-September to November 1 to replenish root reserves for winter survival, especially important with red clover

For further information about grazing clover management, refer to the College of Agriculture publications, available at the local Extension office or in the publication section of the UK Forage website (<https://forages.ca.uky.edu>).

- Renovating Hay and Pastures Fields (AGR-26)
- Weed Control Strategies for Alfalfa and Other Forage Legume Crops (AGR-148)
- Rotational Grazing (ID-143)
- Grazing Red Clover in Kentucky (AGR-33)
- Grazing White Clover in Kentucky (AGR-195)
- Managing Legume Induced Bloat in Cattle (ID-186)

About the Authors

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Table 4. Seedling vigor and stand persistence of white clover varieties sown September 9, 2017, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 11, 2017	Percent Stand								
		2017		2018		2019		2020		2021
		Oct 11	Mar 14	Sep 26	Mar 28	Nov 5	Mar 25	Oct 13	Mar 29	Oct 7
Commercial Varieties-Available for Farm Use										
Patriot	3.2	95	95	96	95	50	45	77	78	75*
Will	4.3	97	98	95	94	50	52	73	78	73*
Durana	3.8	97	97	97	96	38	35	73	75	69*
Alice	3.9	96	96	97	95	42	43	63	64	66*
Kakariki	4.7	99	98	97	95	48	37	65	69	66*
Renovation	3.6	96	95	96	95	40	33	75	77	66*
RegalGraze	4.8	99	99	92	92	38	37	71	75	59
Experimental Varieties										
NFWC04-29	3.7	97	97	95	95	52	47	68	68	63*
Mean	4.0	97	97	95	94	45	41	74	73	67
CV,%	18.5	2	2	3	3	38	36	15	15	19
LSD,0.05	0.9	2	2	4	3	20	17	13	13	15

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 5. Seedling vigor and stand persistence of white clover varieties sown September 5, 2018, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Sep 28, 2018	Percent Stand						
		2018		2019		2020		2021
		Sep 28	Mar 28	Nov 5	Mar 25	Oct 13	Mar 29	Oct 7
Commercial Varieties-Available for Farm Use								
Patriot	2.8	79	62	70	60	68	68	78*
Will	3.9	93	88	87	80	78	75	77*
RegalGraze	4.1	96	89	78	53	62	63	72*
Kopu II	3.5	93	55	63	47	58	58	70*
Alice	3.8	93	64	79	66	62	62	67*
Durana	2.5	84	67	75	55	52	47	55
Mean	3.4	90	71	75	60	63	62	70
CV,%	17.1	9	15	20	23	22	19	15
LSD,0.05	0.7	10	13	18	17	16	14	13

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 6. Stand persistence of white clover varieties sown April 3, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.¹

Variety	Percent Stand			
	2020		2021	
	Jun 5	Sep 30	Mar 29	Oct 7
Commercial Varieties-Available for Farm Use				
Will	38	82	95	89*
Patriot	20	68	91	89*
Durana	30	81	93	86*
Alice	43	78	93	84*
Renovation	38	88	93	84*
Neches	45	83	90	83*
Kopu II	33	78	88	82*
RegalGraze	39	74	91	76
Mean	36	79	91	84
CV,%	47	11	6	12
LSD,0.05	20	11	6	12

¹ This study was originally seeded September 5, 2019, but the entire stand was killed by sclerotinia; it was reseeded April 3, 2020.

*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 7. Seedling vigor and stand persistence of white clover varieties sown September 8, 2020, in a cattle-grazing tolerance study at Lexington, Kentucky.

Variety	Seedling Vigor ¹ Oct 2, 2020	Percent Stand		
		2020		2021
		Oct 2	Jul 6	Oct 7
Commercial Varieties-Available for Farm Use				
Will	4.7	100	98	99*
Alice	4.2	100	92	97*
Dusi	4.3	100	93	97*
Patriot	3.6	95	91	96*
Durana	3.9	97	83	96*
RegalGraze	4.2	100	95	95*
Neches	4.4	100	83	94*
Cresendo	4.3	100	93	94
Kakariki	4.5	99	86	93
Experimental Varieties				
CW9501	3.6	84	91	95*
Mean	4.2	97	91	96
CV,%	10.2	7	7	4
LSD,0.05	0.5	8	8	4

¹ Vigor score based on a scale of 1 to 5 with 5 being the most vigorous seedling growth.

*Not significantly different from the highest numerical value in the column, based on the 0.05 LSD.

Table 8. Proprietors of red clover varieties in current grazing trials in Kentucky.

Variety	Proprietor/KY Distributor
Commercial Varieties-Available for Farm Use	
Barduro	Barenbrug USA
Freedom!	Barenbrug USA
Gallant	Turner Seed
GA9908	Smith Seed Services
Kenland (certified)	Public
SS-0303RCG	Southern States
Experimental Varieties¹	
BARTP9	Barenbrug USA
BARTP11	Barenbrug USA
CW30091	Barenbrug USA
20-AB-RC-3	Ampac Seed
20-LA-RC-1	Ampac Seed
20-LA-RC-2	Ampac Seed

¹ Experimental varieties are not available commercially, but provide an indication of the progress being made by forage breeding companies.

Table 9. Proprietors and clover type of white clover varieties in current grazing trials in Kentucky.

Variety	Type	Proprietor/KY Distributor
Commercial Varieties-Available for Farm Use		
Alice	Intermediate	Barenbrug USA
Crescendo	Ladino	Barenbrug USA
Durana	Intermediate	Pennington Seed
Dusi	Ladino	Barenbrug USA
Kakariki	Ladino	Luisetti Seeds
Kopu II	Intermediate	Ampac Seed
Patriot	Intermediate	Pennington Seed
Neches	Intermediate	Barenbrug USA
Regal Graze	Ladino	Cal/West Seeds
Renovation	Intermediate	Smith Seed
Will	Ladino	Allied Seed
Experimental Varieties¹		
CW9501	Ladino	Barenbrug USA
NFWC04-29	Intermediate	Noble Foundation

¹ Experimental varieties are not available commercially, but provide an indication of the progress being made by forage breeding companies.

Table 10. Summary of 2002-2021 Kentucky white clover grazing tolerance trials in Lexington (stand persistence shown as a percent of the mean of the commercial varieties in the test).

Variety	Type	Proprietor	2002 ^{1,2}	2004	2006 ³	2006 ⁴	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Mean ⁵ (#trials)	
Alice	Intermediate	Barenbrug USA	2yr ⁶	59	98														100	87(8)
Barblanca	Intermediate	Barenbrug USA		118	91	151														120(3)
Canterbury	Dutch	Allied Seed																		72(2)
Colt	Intermediate	Seed Research of OR		114	134	122					51									72(2)
Crescendo	Ladino	Cal/West	84		72															123(3)
Durana	Intermediate	Pennington		83	105	103	115	102	107	126	86	81	113	152	86	102	79	102		78(2)
GWC-AS10	- ⁷	Ampac Seed																		103(15)
Insight	Ladino	Allied Seed			77															-
Ivory	Intermediate	DLF Pickseed	132	142																-
Ivory II	Intermediate	DLF Pickseed				102														137(2)
Kakariki	Ladino	Luisetti Seeds													97					-
Kopu II	Intermediate	Ampac Seed			77	122	96	93	113	112	86	106	93	87	107		100	98		99(13)
KY Select	Intermediate	KY Agr Ex. Sta.					105		83											94(2)
Neches	- ⁷	Barenbrug USA					100	111	110	123	102	132	109	123	107	111	111	106		102(2)
Patriot	Intermediate	Pennington		110	137	122					87									114(15)
Pinnacle	Ladino	Allied Seed																		-
Rampart	- ⁷	Oregro Seeds					90													-
Regal	Ladino	Public	92		54	54	93	103												80(5)
Regal Graze	Ladino	Cal/West		84	87	105	90	87	93	72	94	81	102	87	107	87	103	90		91(15)
Renovation	Intermediate	Smith Seed																		100
Resolute	Intermediate	Southern States								65										91(5)
Seminole	Ladino	Saddle Butte Ag. Inc.		75	97	91														91(3)
Tillman II	Ladino	Caudill Seed	92																	97(5)
WBDX	Dutch	Saddle Butte Ag. Inc.							70											-
Will	Ladino	Allied Seed			117	87	107	108	143	115	133	157	111	120	114	108	110	106		116(15)

¹ Year trial was established.

² Use this summary table as a guide in making variety decisions, but refer to specific yearly reports to determine statistical differences in stand persistence between varieties. To find actual persistence ratings, look in the yearly report for the final year of each specific test. For example, the trial planted in 2016 was grazed for four years so the final persistence report would be "2020 Red and White Clover Grazing Tolerance Report" archived in the UK Forage website (<https://forages.ca.uky.edu>).

³ This trial was planted in the spring of 2006 due to poor establishment of the fall 2005 planting.

⁴ This trial was planted in the spring of 2008 due to poor establishment of the fall 2007 planting.

⁵ Mean only presented when respective variety was included in two or more trials.

⁶ Number of years of data.

⁷ Type was not provided by the company.

